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Future skills needs in EU and skills transferability in 2020: sector meta-analysis

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Abstract

Employment and its changes caused by restructuring are topics, which European Union pays attention to in long-run horizon, and the experience of current economic crisis confirms the rectitude of this approach. Structural changes always generate a need of the re-emplacement of laid off workers. Possibilities of their emplacement is strongly influenced by knowledge and skills offered by workers and demanded by employers. Acquaintance with future demand on knowledge and skills applicable across whole economy or applicable in different segments of labour market, i.e. in concrete occupations and sectors, enables effective targeting of educational activities at both individual and social levels, which will lead to higher flexibility of labour market mirrored mainly by high occupational mobility and low structural unemployment. The aim of this paper is to analyse future knowledge and skills needs recognized in 18 future-oriented sector analyses, published by European Commission in 2009, and identify knowledge and skills applicable in individual sectors, occupations and on the whole labour market, i.e. identify transferable knowledge and skills.

Keywords

Employability, EU sector analyses, future skills needs, human capital, occupational mobility, transferable skills.

JEL Classification: J23, J24, J62

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1. Introduction

Employment and its changes caused by restructuring are topics, which European Union pays attention to in long-run horizon, and the experience of current economic crisis confirms the rectitude of this approach. Structural changes always generate a need of the re-emplacement of laid off workers. Possibilities of their emplacement is strongly influenced by knowledge and skills offered by workers and demanded by employers. For structural unemployment minimizing and employment strengthening it is necessary to support the accumulation of those parts of human capital, which will be demanded in the future in individual occupations, sectors or in whole economy.

The European Commission launched many initiatives and projects leading to the identification of future skills need, which form the first step to enforce employment in Europe. For the identification of future skills needs both a quantitative modelling, e.g. Future skill needs in Europe (Cedefop, 2009a), Future skill supply in Europe (Cedefop, 2009b), and a qualitative modelling, e.g. 18 future-oriented sector analyses (European Commission, on-line), were applied.

The aim of this paper is to analyse future knowledge and skills needs recognized in above stated sector analyses and identify knowledge and skills applicable in individual sectors, occupations and on the whole labour market, i.e. transferable knowledge and skills in 2020.

The knowledge of future transferability of individual knowledge and skills and its importance for educational system on the present are going to be revealed gradually. Different sources of information on future knowledge and skills needs are identified in

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Section 2. The next section is devoted to a description of a methodology employed for an identification of future transferability of knowledge and skills on the basis of selected qualitative data. The results on the analysis will be presented in Section 4 and its consequeces for current education curricula in Section 5.

2. Information on future skills needs

Different sources of information on future knowledge and skills needs are discussed in this section. EU sector studies, as a source of information analysed in this paper, are described in details.

2.1 Overview of possibilities of future skills needs identification

Despite many sources of information on future development it is not easy to find relevant sources devoted to identification of individual knowledge and skills, which are going to be highly demanded by employers at future labour market. The more aggregated outputs are required (European level instead of regional/national level or whole economy instead of individual sectors or occupations), the more limited the sources are.

Studies forecasting future skills needs purely on the basis of a quantitative modelling usually do not describe a future demand on individual knowledge and skills, but future trends of employment in individual occupations or sectors (e.g., Cedefop, 2009a and Cedefop, 2009b in EU; Dickerson et al., 2006 in UK; Koucký and Lepič, 2008 in CZ). Although the future employment in individual occupations and sectors is closely related to future demand on knowledge and skills, it provides qualitatively different information (e.g., changes of qualification requirements for individual occupations are not taken into account). An advantage of these studies is the ability to cover whole economy, as well as individual sectors and occupations.

Studies using purely or partly a qualitative modelling are usually able to identify concrete knowledge and skills, which are expected to be important in the future. The focus on individual knowledge and skills is enabled by using expert opinion as main source of information. On the other side, it has to be emphasized that even using expert opinion does not solve the problem of identification of entirely new knowledge and skills. Further limitation of this type of studies is their usual focus on some sector (e.g., Biopharma-pharmachem sector or Wholesale and retail sector in IE, see EGFSN, 2010a and 2010b; ICT services or Power industry in CZ, see NVF, 2009).

The lack of a systematic description of future knowledge and skills needs covering all economic sectors at EU level or even at national level for all 27 EU member states led to the realization of several activities. The creation of 18 qualitative EU sector studies (for more information see European Commission, on-line), which were based on a common methodology enabling comparison of results among sectors, and piloting of a new methodology of Cedefop enabling forecasting of knowledge and skills needs, although the results of the piloting are not still available (information presented by Cedefop at Restructuring forum in Brussels on 7–8 December 2009), belong among the most important ones.

As flows from above, the 18 sector studies represent a unique source of information on future knowledge and skills needs at EU level. It is the reason, why they were used for the following meta-analysis in order to identify emergent knowledge and skills applicable in individual sectors (defined by NACE, i.e. Classification of Economic Activities in the European Community), occupations (defined by ISCO 88, i.e. International Standard Classification of Occupations) and on the whole labour market in 2020.

2.2 EU sector studies

In order to ensure sound change management, the Commission has conducted 18 sectoral studies that seek to identify emerging competences and future skills needs. By applying a common foresight scenario-based approach, these studies provide options both for anticipating and adapting to change (European Commission, on-line). These sector analyses cover areas of

- automotive sector (NACE 34),
- building of ships and boats (NACE 35.1),
- chemicals, pharmaceuticals, rubber and plastic products (NACE 24, 25),
- computer, electronic and optical products (NACE 30, 32, 33),
- defence industry,
- distribution and trade (NACE 50, 51, 52),
- electricity, gas, water and waste (NACE 40, 41, 90),
- electromechanical engineering (NACE 29, 31),
- financial services (NACE 65, 66, 67),
- furniture (NACE 36.1),
- health and social work (NACE 85),
- hotels, restaurants and catering (NACE 55),
- non-metallic materials (NACE 26),
- other services, maintenance and cleaning (NACE 93, 95),
- post and telecommunications (NACE 64),
- printing and publishing (NACE 22),
- textiles, apparel and leather products (NACE 17, 18, 19),
- transport and logistics (NACE 60, 61, 62, 63).

Realization of analyses was conducted by a common methodology framework (Rodrigues, 2007), so a structure of studies is very similar for all sectors. Studies provide information on the development of each sector, main drivers of its future development, possible scenarios up to 2020, knowledge and skills demanded in the future and measures to do to meet future knowledge and skills needs. It is necessary to stress that sector studies do not identify all knowledge and skills, which will be necessary in each occupation, but rather the most important ones for meeting challenges defined by main drivers of future development in each sector (Rodrigues, 2007), i.e. knowledge and skills whose importance will increase in the comparison with the present. The result of following meta-analysis is determined by this fact, i.e. it provides information on transferability of emergent knowledge and skills in the year 2020.

3. Meta-analysis methodology

Despite the common methodology framework, outputs of the EU sector studies can not be thoughtlessly aggregated to extract information on future knowledge and skills needs and their transferability. The differences of individual sector studies have to be taken into account. Therefore, this section is devoted to a detailed description of methodology applied in this paper.

3.1 Sectors of economy

Although the EU sector studies were based on a common methodology the structure of their output is different in various sectors. This fact represents a significant barrier of using of all 18 sector analyses for the meta-analysis.

Only studies describing future knowledge and skills needs on the basis of a common knowledge and skills framework, see Section 3.3, were used for the meta-analysis. Studies describing ad hoc defined knowledge and skills, which caused their mutual incomparability, and studies examining future changes in an employment structure instead of changes in knowledge and skills needs had to be excluded. From 18 sectors, covered by EU sector studies, only 11 of them were used for the meta-analysis of future knowledge and skills needs; detailed information on these sectors is contained in Table 1.

The 11 sectors used for the meta-analysis represented approximately 31.33 per cent of GDP and 32.24 per cent of employment in EU27 in 2007, as the Table 1 shows. The annual growth of GDP in all stated sectors was positive during the period 2000–2007 and 8 sectors even reached the growth exceeding the average annual growth of GDP in EU27.

3.2 Groups of occupations

The most interesting part of each sector study was a list of *knowledge and skills for the future*, i.e. knowledge and skills expected to be highly demanded in 2020. They were identified on the basis of experts' opinion concerning knowledge and skills necessary for a future work performance in key occupations of each sector. It can be stated that differences among sectors led to a specification of different sets of occupations for each sector. This ad hoc approach,

Table 1 Sectors used for meta-analysis (sorted according to NACE)

Sector	NACE rev. 1.1	Share of GDP, 2007 (%)	Annual growth of GDP, 2000–2007 (%)	Employment, 2007 (ths. persons)	Annual growth of empl., 2000–2007 (%)
Printing and publishing	22	1.03	1.15	2 717[I]	–7.84 [I]
Chem., pharm., rubber and plastic products	24, 25	2.92	2.69	3 550	–0.57
Non-metallic materials	26	0.82	9.71	1 685	–7.62
Computers, electronic and optical products	30, 32, 33	1.86	6.31	3822[II]	–0.76[II]
Furniture	36.1	0.62[III]	0.03[III]	2 385[IV]	4.47[IV]
Electricity, gas, water and waste	40, 41, 90	2.31	1.25	1 698[V]	–2.17[V]
Distribution and trade	50, 51, 52	11.94	2.39	33 458	1.06
Transport and logistics	60, 61, 62, 63	4.71	2.86	13 012	0.67
Post and telecommunications	64	2.95	5.05		
Health and social work	85	6.49	2.32	20 331	1.83
Other services, maintenance and cleaning	93, 95	1.28[VI]	6.98 [VI]	n.a.	n.a.
EU 27		100.00	2.19	224 323	0.96

Source: Eurostat, on-line.

Note: I – data for NACE 21, 22; II – data for NACE 30, 31, 32, 33; III – data for NACE 36; IV – data for NACE 36, 37; V – data for NACE 40, 41; VI – data for NACE 93, 95, 96, 97.

which was not directly connected with any classification of occupations, led to the incomparability of concrete occupations among sector studies.

The realization of the sector meta-analysis was therefore conditioned by a creation of groups of occupations, which would be comparable across all sector studies. The International Standard Classification of Occupations (ISCO 88) was used as an appropriate tool for this task. All occupations, or more precisely occupational clusters, used in the sector studies were classified according to ISCO 88; some of them belonged into more ISCO 88 groups, which meant multiplication of records. A different number of records in main groups of ISCO 88 classification enabled an identification of *crucial groups of occupations*, i.e. groups of occupations crucial for a further development of analysed sectors. The more records were available for the main groups of ISCO 88 the more detailed groups of occupations were created.

This procedure led to the creation of following occupational groups:

- managers (ISCO 12, 13),
- physical, mathematical and engineering science professionals (ISCO 21),
- life science and health professionals (ISCO 22),
- business professionals (ISCO 241),
- other professionals except business professionals (ISCO 242, 243, 244, 245),
- physical and engineering science associate professionals (ISCO 31),
- business and administrative associate professionals (ISCO 341, 342, 343),
- clerks (ISCO 4),
- service workers and shop and market sales workers (ISCO 5),
- craft and related trades workers (ISCO 7),
- plant and machine operators and assemblers (ISCO8),
- elementary occupations (ISCO 9).

3.3 Analysed skills

Different occupations in different sectors require various skills and knowledge, which can be both general and specific. The meta-analysis takes into consideration only general knowledge and skills (although specific ones were also discussed in the sector studies), because they have a potential to be transferred from one occupation to another as well as from one sector to another.

The list of knowledge and skills, which were discussed by all sector analyses and are therefore taken into consideration by the meta-analysis, is contained in Table 2.

3.4 Data collecting and processing

The forecast of future demand on various knowledge and skills is strongly influenced by forecast of further development of sectors, so it is very different among projected scenarios of possible development in each sector. Scenarios based on globalization, fierce competition and following development of innovations, technology and specialization in knowledge-intensive goods and services were chosen for this meta-analysis, because it can be assumed that scenarios based on stated elements are the most demanding ones from a perspective of future knowledge and skills needs and they lead to the maintaining of a current position of European Union in the world economy or even its improvement. The Table 3 summarizes scenarios of the future development in relevant sectors, which were taken into account by the meta-analysis

After the selection of scenarios there was no other barrier for data collecting. The information on the future need of individual knowledge and skills was available for relevant occupations in above stated sectors and it took the value *yes* or *no*. The meta-analysis interpreted the value *yes* as 100 per cent need of the knowledge or skill in the future (up to 2020) and the value *no* as 0 per cent need of the knowledge or skill in the future. If there were more records for occupations belonging to the same occupational group and sector the percentage values relevant for individual occupations were averaged to reach much more precise value of the future need of analysed knowledge or skill in the occupational group. This process led to a description of future knowledge and skills needs for 98 occupational groups in 11 sectors, whereas many of these descriptions were based on information relevant for more than one occupation defined by the sector analyses, as Table 6 in Appendix shows. Each of the 98 knowledge and skills profiles of concrete occupational group in respective sector, regardless the number of occupations used for its specification, constitutes one information unit on future knowledge and skills needs, which were used for further analysis. The analysis is based on a quantification of the share of occupational groups or sectors or both, where individual knowledge and skills will be applicable. (The percentage value of the share is stated for each knowledge and skill in Tables 4, 5 and Tables 7, 8 and 9 in Appendix.)

A database of knowledge and skills profiles of individual occupational groups in respective sectors enabled to identify

- knowledge and skills applicable across occupational groups within given sectors,

- knowledge and skills applicable across sectors within given occupational groups,
- knowledge and skills applicable across sectors and occupational groups.

Values of the share of occupational groups or sectors or both, where individual knowledge and skills will be applicable enabled to distinguish

- highly transferable knowledge and skills with the percentage value [66.6,100],
- partly transferable knowledge and skills with the percentage value [33.3,66.6),
- hardly or non-transferable knowledge and skills with the percentage value [0,33.3).

Relevancy of the values is given by the number of observations used for calculations.

The transferability is, for the purpose of this paper, defined as the assumed future applicability of individual knowledge or skill in more sectors or occupational groups.

3.5 Limits of meta-analysis methodology

It is necessary to mention also limits of results on future knowledge and skills transferability contained in Section 4. These limits flow mainly from uncertainty of future development and limited information available in the EU sector studies. Among the main factors determining the relevancy of results belong:

- application of future development scenario based on globalization, fierce competition and following development of innovations, technology and specialization in knowledge-intensive goods and services,
- limited number of sectors representing approximately ⅓ of GDP and employment in EU27,
- limited number of occupations, whose future skills needs were described,
- focus mainly on general knowledge and skills,
- missing distinction of different levels of relevant knowledge and skills,
- missing differentiation of an importance of emergent knowledge and skills (e.g. by using weights according to the employment in respective occupations and sectors),
- missing information on entirely new knowledge and skills, which will appear in the future.

Table 2 Knowledge and skills analysed in meta-analysis

Area	Knowledge and skills
Knowledge	Legislative, regulatory, E-skills, Technical/product knowledge
Social Skills	Team working, Social perceptiveness, Communication, Networking, Language, Intercultural
Problem solving	Analytical skills, Interdisciplinarity, Initiative, Multi-skilling, Creativity (Innovation)
Self-management	Planning, Stress and time management, Flexibility, Multi-tasking
Entrepreneurship	Understanding suppliers, customers, Business development, Marketing skills, Trend setting/spotting
Management	Strategic and visionary, Coaching and team building, Collegial management style, Change management, Project management, Process optimizing, Quality management

Table 3 Scenarios of further development of sectors up to 2020

Sector	Scenario	Description of scenario (source)
Printing and publishing	Free Transformation	Gelderblom et al., 2009: 70
Chem., pharm., rubber and plastic products	Green and global	Zee et al., 2009a: 68
Non-metallic materials	Innovation-led growth	Zee et al., 2009b: 51
Computers, electronic and optical products	High-end Customer Hi-Wi-Fi	Zee et al., 2009c: 57
Furniture	Global customisation	Gijsbers et al., 2009: 54
Electricity, gas, water and waste	Green efficiency	Dijkgraaf et al., 2009a: 58
Distribution and trade	Shop Around the Clock	Giessen et al., 2009: 74
Transport and logistics	Shifting Gears	Zee et al., 2009d: 96
Post and telecommunications	Email-round, Tech-com	Dijkgraaf et al., 2009b: 72, 143
Health and social work	Flex care	Dijkgraaf et al., 2009c: 62
Other services, maintenance and cleaning	Professional	Dijkgraaf et al., 2009d: 40

Table 4 Knowledge and skills highly transferable within sectors (across occupational groups)

Sectors	Highly transferable competences across occupation groups	Data relevancy
A. Printing and publishing (NACE 22)	Technical/product knowledge (100.0), Flexibility (100.0), Communication (87.5), Team working (75.0), Stress and time management (75.0), Multi-tasking (75.0), Project management (75.0), E-skills (68.8), Analytical skills (68.8)	8 occupational groups (I, II, IV, V, VIII, X, XI, XII) 9 occupational clusters defined in sector studies
B. Chem., pharm., rubber & plastic products (NACE 24, 25)	E-skills (97.5), Flexibility (95.0), Team working (87.5), Language (85.0), Intercultural (85.0), Legislative, regulatory (66.7)	10 occupational groups (I, II, IV, V, VII, VIII, IX, X, XI, XII) 13 occupational clusters defined in sector studies
C. Non-metallic materials (NACE 26)	E-skills (100.0), Communication (100.0), Language (100.0), Flexibility (100.0), Intercultural (94.4), Technical/product knowledge (83.3), Team working (72.2), Analytical skills (66.7)	9 occupational groups (I, II, IV, V, VI, VIII, X, XI, XII) 12 occupational clusters defined in sector studies
D. Computers, electronic and optical products (NACE 30, 32, 33)	E-skills (100.0), Flexibility (100.0), Stress and time management (72.7), Team working (68.2), Commu-nication (68.2)	11 occupational groups (I, II, IV, V, VI, VII, VIII, IX, X, XI, XII) 18 occupational clusters defined in sector studies
E. Furniture (NACE 36.1)	E-skills (100.0), Communication (96.7), Language (96.7), Flexibility (95.0), Intercultural (90.0), Legislative, regulatory (85.0), Analytical skills (83.3), Planning (83.3)	10 occupational groups (I, II, IV, V, VI, VII, VIII, X, XI, XII) 18 occupational clusters defined in sector studies
F. Electricity, gas, water and waste (NACE 40, 41, 90)	Stress and time management (100.0), Flexibility (94.4), Technical/product knowledge (72.2), Creativity (72.2), Analytical skills (66.7), Multi-skilling (66.7), Project management (66.7)	9 occupational groups (I, II, IV, V, VI, VIII, X, XI, XII) 11 occupational clusters defined in sector studies
G. Distribution and trade (NACE 50, 51, 52)	E-skills (100.0), Communication (90.7), Flexibility (90.7), Stress and time management (75.9), Lan-guage (74.1)	8 occupational groups (I, III, IV, VII, VIII, IX, X, XI, XII) 15 occupational clusters defined in sector studies
H. Transport and logistics (NACE 60, 61, 62, 63)	Legislative, regulatory (100.0), E-skills (100.0), Intercultural (96.9), Communication (93.8), Lan-guage (93.8), Process optimizing (76.9), Flexibility (71.9), Analytical skills (70.0)	8 occupational groups (I, IV, VI, VIII, IX, X, XI, XII) 18 occupational clusters defined in sector studies
I. Post and telecommunications (NACE 64)	Flexibility (90.0), Stress and time management (75.0), Understanding suppliers and customers (67.5), Process optimizing (67.5)	10 occupational groups (I, II, IV, V, VI, VII, VIII, X, XI, XII) 19 occupational clusters defined in sector studies
J. Health and social work (NACE 85)	Social perceptiveness (100.0), Communication (100.0), Flexibility (100.0), Intercultural (87.5)	8 occupational groups (I, III, V, VIII, IX, X, XI, XII) 9 occupational clusters defined in sector studies
K. Other services, maintenance and cleaning (NACE 93, 95)	Legislative, regulatory (100.0), Communication (100.0), Understanding suppliers and customers (100.0), Quality management (91.7), E-skills (83.3), Social perceptiveness (83.3), Planning (83.3)	6 occupational groups (I, VII, VIII, IX, X, XII) 7 occupational clusters defined in sector studies

Note: The percentage value of the share of occupational groups (see data relevancy column) within separate sectors, where individual knowledge and skills are applicable is stated in parentheses. For identification of occupation groups stated in the *Data relevancy* column see Table 5.

Table 5 Knowledge and skills highly transferable within occupational groups (across sectors)

Occupation groups	Highly transferable competences across sectors	Data relevancy
I. Managers (ISCO 12, 13)	Understanding suppliers and customers (100.0), Business development (100.0), Trend setting/spotting (100.0), Communication (90.9), Language (90.9), Intercultural (90.9), Flexibility (90.9), Strategic and visionary (90.9), E-skills (86.4), Change management (86.4), Networking (81.8), Marketing skills (81.8), Stress and time management (77.3), Legislative, regulatory (68.2), Creativity (68.2), Planning (68.2)	11 sectors (A, B, C, D, E, F, G, H, I, J, K) 14 occupational clusters defined in sector studies
II. Physical, mathematical and engineering science professionals (ISCO 21)	Technical/product knowledge (89.3), Flexibility (85.7), Team working (84.5), E-skills (82.1), Communication (81.0), Analytical skills (81.0), Stress and time management (72.6), Intercultural (69.0), Understanding suppliers and customers (69.0), Networking (67.9), Creativity (66.7)	7 sectors (A, B, C, D, E, F, I) 7 occupational clusters defined in sector studies
III. Life science and health professionals (ISCO 22)	E-skills (100.0), Technical/product knowledge (100.0), Communication (100.0), Language (100.0), Intercultural (100.0), Flexibility (100.0), Quality management (100.0), Legislative, regulatory (75.0), Networking (75.0)	2 sectors (G, J) 3 occupational clusters defined in sector studies
IV. Business professionals (ISCO 241)	Legislative, regulatory (94.4), Flexibility (94.4), Language (88.9), E-skills (83.3), Analytical skills (79.6), Understanding suppliers and customers (79.6), Communication (77.8), Intercultural (77.8), Stress and time management (75.9), Networking (70.4), Business development (70.4)	9 sectors (A, B, C, D, E, F, G, H, I) 16 occupational clusters defined in sector studies
V. Other professionals except business professionals (ISCO 242, 243, 244, 245)	E-skills (87.5), Networking (87.5), Language (87.5), Flexibility (87.5), Legislative, regulatory (75.0), Intercultural (75.0)	8 sectors (A, B, C, D, E, F, I, J) 8 occupational clusters defined in sector studies
VI. Physical and engineering science associate professionals (ISCO 31)	Technical/product knowledge (95.8), Flexibility (95.8), Communication (91.7), Analytical skills (83.3), E-skills (75.0), Team working (75.0)	6 sectors (C, D, E, F, H, I) 10 occupational clusters defined in sector studies
VII. Business and administrative associate professionals (ISCO 341, 342, 433)	E-skills (100.0), Understanding suppliers and customers (80.6), Legislative, regulatory (77.8), Flexibility (77.8), Analytical skills (69.4)	6 sectors (B, D, E, G, I, K) 10 occupational clusters defined in sector studies
VIII. Clerks (ISCO 4)	E-skills (90.9), Flexibility (90.9), Communication (86.4), Team working (68.2), Language (68.2), Intercultural (68.2), Planning (63.6)	11 sectors (A, B, C, D, E, F, G, H, I, J, K) 16 occupational clusters defined in sector studies
IX. Service workers and shop and market sales workers (ISCO 5)	E-skills (100.0), Communication (100.0), Intercultural (100.0), Initiative (100.0), Flexibility (100.0), Language (83.3), Team working (66.7), Social perceptiveness (66.7), Creativity (66.7), Planning (66.7), Stress and time management (66.7), Multi-tasking (66.7)	6 sectors (B, D, G, H, J, K) 6 occupational clusters defined in sector studies
X. Craft and related trades workers (ISCO 7)	Flexibility (90.9), Technical/product knowledge (86.4), Communication (86.4), E-skills (68.2)	11 sectors (A, B, C, D, E, F, G, H, I, J, K) 18 occupational clusters defined in sector studies
XI. Plant and machine operators and assemblers (ISCO 8)	Flexibility (100.0), Technical/product knowledge (85.0), Communication (80.0)	10 sectors (A, B, C, D, E, F, G, H, I, J) 20 occupational clusters defined in sector studies
XII. Elementary occupations (ISCO 9)	Flexibility (81.8), Communication (72.7)	11 sectors (A, B, C, D, E, F, G, H, I, J, K) 11 occupational clusters defined in sector studies

Note: The percentage value of the share of sectors (see data relevancy column) within separate occupational groups, where individual knowledge and skills are applicable is stated in parentheses. For identification of occupation sectors in the *Data relevancy* column see Table 4.

4. Transferable competences in 2020

The aim of 18 EU sector studies from the year 2009 (European Commission, on-line), whereas 11 of them were used as data sources for this paper, was to identify the most important knowledge and skills for meeting challenges determined by main drivers of future development in selected sectors, i.e. knowledge and skills whose importance, in comparison with present, will increase up to the year 2020.

Emergent skills, identified by the sector studies, were examined from the point of view of their future applicability in different occupational groups, sectors and the economy as a whole, i.e. from the point of view of their future transferability. Knowledge and skills highly transferable, i.e. applicable in 66.6 or more per cent of occupational groups or sectors, are discussed in this section; less transferable ones can be found in Appendix.

The overview of highly transferable knowledge and skills within individual sectors (across occupational groups) is contained in Table 4; for detailed information see Table 8 in Appendix that involves also information on less transferable knowledge and skills.

The overview of highly transferable knowledge and skills within individual occupational groups (across sectors) is contained in Table 5. For detailed information see Table 9 in Appendix which involves also information on less transferable knowledge and skills.

The database created from information contained in the sector studies enabled to evaluate not only future transferability of individual knowledge and skills across sectors and across occupational groups (see Tables 4, 5 and Tables 8 and 9 in Appendix), but also future transferability of knowledge and skills across whole labour market, i.e. knowledge and skills demanded regardless sector and occupation group. Flexibility (90.1), Communication (82.1), E-skills (80.6), Intercultural skills (67.8) and Language skills (66.8) will belong among highly transferable (widely demanded) skills across labour market. Also skills partly transferable across labour market in the future can be identified; they are Technical/product knowledge (62.2), Stress and time management (58.6), Team working (57.3), Legislative, regulatory (54.3), Analytical skills (51.4), Understanding suppliers, customers (49.4), Creativity (45.5), Planning (45.2), Initiative (42.2), Networking (41.3), Quality management (39.7), Multi-skilling (36.6), Process optimizing (34.6) and Social perceptiveness (33.9). For more information see Table 7 in Appendix.

Although the lack of relevant literature on future knowledge and skills needs at EU level was identified in Section 2.1, the results can be compared with findings of Eurobarometr No. 304 from November 2010 (Gallup Organization, 2010). The Eurobarometr was focused on employability of graduates and one question was devoted to evaluation of future importance of selected skills for graduates' employability in next 5–10 years. Skills were ordered as follows: Sector-specific skills (45%), Numeracy, Literacy and E-skills (43%), Communication skills (39%), Team working skills (37%), Analytical and problem-solving skills (32%), Foreign language skills (31%), Ability to adapt to and act in new situations (25%) and Planning and organisational skills (22%). Considering different methodologies of compared results, different target groups of studies, and uncertainty of future development, it can be stated that E-skills and Communication skills were identified as very important for the future in both the EU sector studies and the Eurobarometr, whereas flexibility and language skills were significantly undervalued by the Eurobarometr survey. The rank of other skills does not differ significantly.

5. Present implications of future demand

Acquaintance with future demand on knowledge and skills applicable across whole economy or applicable in different segments of labour market, i.e. in concrete occupations and sectors, enables effective targeting of educational activities at both individual and social levels. Accumulation of transferable knowledge and skills will lead to higher flexibility and adaptability of individuals in the labour market, which will be mirrored mainly by high occupational mobility and low structural unemployment.

Identification of future requirements on knowledge and skills represents important input for an adaptation of current education curricula. An implementation of future based curricula into the education system would lead to the development of knowledge and skills, which will be required by employers in the future, i.e. it would support real applicability and employability of future graduates in the labour market. It has to be emphasized that it is necessary to identify right set of knowledge and skills, which should be developed by different types of educational facilities. Primary education should be focused on the development of knowledge and skills applicable across whole labour market, i.e. flexibility, communication, e-skills, intercultural skills and language skills (see Section 4), which should be further developed by institutions of secondary and tertiary education. The main task of secondary and tertiary education should consist in the development of knowledge and skills applicable in occupations and sectors corresponding to the focus of concrete educational facility. For example, university with an IT study programme should develop tech-

nical/product knowledge, flexibility, team working, e-skills, communication, analytical skills, stress and time management, intercultural skills, understanding suppliers and customers, networking and creativity, which correspond to the needs of Computing professionals (subcategory of ISCO 21) and Computers, electronic and optical products sector (see Section 4, Table 4 and 5). The development of generally applicable knowledge and skills, which would be often already incorporated into the curricula as a part of requirements typical for given occupational group or sector, should continue as well.

Information on future knowledge and skills needs is very useful not only for education system, but also for individuals and firms. They can develop knowledge and skills, which will be necessary for their future employability (applicability) in the case of individuals and for survival in the case of firms. Both individuals and firms should develop knowledge and skills, which correspond to the sector and/or occupations relevant for them.

6. Conclusions

Employment and its changes caused by restructuring are topics, which European Union pays attention to in long-run horizon, and the experience of current economic crisis confirms the rectitude of this approach. Structural changes always generate a need of the re-emplacement of laid off workers. Possibilities of their emplacement is strongly influenced by knowledge and skills offered by workers and demanded by employers. For structural unemployment minimising and employment strengthening it is necessary to support the accumulation of those parts of human capital, which are/will be transferable among maximum number of occupations and sectors.

Existing sources of information on future knowledge and skills needs at EU level are limited. In fact there are either studies focused on future trends of employment in different occupations, sectors and EU economy as a whole, which despite their potential do not identify individual knowledge and skills, or studies describing future knowledge and skills needs in conditions of given sector and state. The lack of information of this type at EU level led to the realization of several activities. The creation of 18 qualitative EU sector studies and piloting of a new methodology of Cedefop enabling forecasting of knowledge and skills needs belong among the most important ones.

The 18 sector studies represent a unique source of information on future knowledge and skills needs at EU level. It is the reason, why they were used for the meta-analysis in order to identify emergent knowledge and skills applicable in individual sectors, occupations and on the whole labour market in 2020. Flexibility, communication, e-skills, intercultural skills and language skills were identified as skills highly transferable across whole labour market, i.e. usable in nearly all occupational groups and sectors defined in the paper. It has to be emphasized that knowledge and skills identified as highly transferable across whole labour market can differ from the ones identified as highly transferable in different occupational groups or sectors due to their specific environment.

Identification of future requirements on knowledge and skills represents important input for an adaptation of current education curricula. An implementation of future based curricula into the education system would lead to the development of knowledge and skills, which will be required by employers in the future, i.e. it would support real applicability and employability of future graduates in the labour market. It has to be emphasized that it is necessary to identify right set of knowledge and skills, which should be developed by different types of educational facilities. Primary education should be focused on the development of knowledge and skills applicable across whole labour market, i.e. flexibility, communication, e-skills, intercultural skills and language skills, which should be further developed by institutions of secondary and tertiary education. The main task of secondary and tertiary education should consist in the development of knowledge and skills applicable in occupations and sectors corresponding to the focus of concrete educational facility. For example, university with an IT study programme should develop technical/product knowledge, flexibility, team working, e-skills, communication, analytical skills, stress and time management, intercultural skills, understanding suppliers and customers, networking and creativity, which correspond to the needs of Computing professionals (subcategory of ISCO 21) and Computers, electronic and optical products sector (see Section 4, Table 4 and 5). The development of generally applicable knowledge and skills, which would be often already incorporated into the curricula as a part of requirements typical for given occupational group or sector, should continue as well.

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Appendix

Table 6 Structure of information on knowledge and skills needs available in relevant structural studies

	Printing and publishing	Chem., pharm., rubber and plastic products	Non-metallic materials	Computers, electronic and optical products	Furniture	Electricity, gas, water and waste	Distribution and trade	Transport and logistics	Post and telecomm.	Health and social work	Other services, maintenance and cleaning
Managers (ISCO 12, 13)	1	1	1	1	1	1	2	2	2	1	1
Physical, mathematical and engineering science professionals (ISCO 21)	1	3	2	3	3	2			2		
Life science and health professionals (ISCO 22)							1			2	
Business professionals (ISCO 241)	1	2	2	2	3	1	2	1	2		
Other professionals except business professionals (ISCO 242, 243, 244, 245)	1	1	1	1	2	1			1	1	
Physical and engineering science associate professionals (ISCO 31)			1	1	1	1		4	2		
Business and administrative associate professionals (ISCO 341, 342, 343)		1		2	2		3		1		1
Clerks (ISCO 4)	1	1	1	1	1	1	2	2	4	1	1
Service workers and shop and market sales workers (ISCO 5)		1		1			1	1		1	1
Craft and related trades workers (ISCO 7)	2	1	1	3	2	1	1	2	2	1	2
Plant and machine operators and assemblers (ISCO 8)	1	1	2	2	2	2	2	5	2	1	
Elementary occupations (ISCO 9)	1	1	1	1	1	1	1	1	1	1	1

Note: Grey cells represent available information on future skills needs in defined occupational groups and sectors acquired from relevant structural studies. White numbers in grey cells represent the number of different occupations, defined in the structural studies, used for specification of knowledge and skills needs in each occupational group and sector. Each grey cell constitutes one information unit on knowledge and skills needs used for further analysis regardless how many occupations were used for its specification.

Table 7 Knowledge and skills transferable across whole labour market

Knowledge and skills transferable across occupational groups and sectors	
NACE / ISCO 88	**All sectors**
All occupations	**Flexibility (90.1), Communication (82.1), E-skills (80.6), Intercultural (67.8), Language (66.8)** Technical / product knowledge (62.2), Stress and time management (58.6), Team working (57.3), Legislative, regulatory (54.3), Analytical skills (51.4), Understanding suppliers, customers (49.4), Creativity (45.5), Planning (45.2), Initiative (42.2), Networking (41.3), Quality management (39.7), Multi-skilling (36.6), Process optimizing (34.6), Social perceptiveness (33.9) *Business development (29.8), Interdisciplinarity (29.1), Multi-tasking (29.0), Project management (27.3), Trend setting / spotting (25.7), Change management (22.5), Marketing skills (21.5), Strategic and visionary (20.5), Coaching and team building (18.1), Collegial management style (5.2)*

Table 8 Knowledge and skills transferable within sectors

Knowledge and skills transferable within sectors (across occupational groups)					
NACE / ISCO 88	**A. Printing and publishing (NACE 22)**	**B. Chem., pharm., rubber & plastic products (NACE 24, 25)**	**C. Non-metallic materials (NACE 26)**	**D. Computers, electronic and optical products (NACE 30, 32, 33)**	**E. Furniture (NACE 36.1)**
All occupation groups	***Technical/product knowledge (100.0), Flexibility (100.0), Communication (87.5), Team working (75.0), Stress and time management (75.0), Multi-tasking (75.0), Project management (75.0), E-skills (68.8), Analytical skills (68.8)*** Initiative (62.5), Social perceptiveness (56.3), Creativity (56.3), Understanding suppliers and customers (56.3), Business development (56.3), Networking (50.0), Language (50.0), Intercultural (50.0), Strategic and visionary (50.0), Coaching and team building (43.8), Quality management (37.5) *Multi-skilling (31.3), Marketing skills (31.3), Process optimizing (31.3), Interdisciplinarity (25.0), Trend setting/spotting (25.0), Legislative, regulatory (12.5), Change management (12.5), Planning (6.3), Collegial management style (0.0)*	***E-skills (97.5), Flexibility (95.0), Team working (87.5), Language (85.0), Intercultural (85.0), Legislative, regulatory (66.7)*** Communication (65.0), Initiative (62.5), Multi-tasking (40.0), Understanding suppliers and customers (40.0), Trend setting/spotting (40.0), Technical/product knowledge (37.5), Networking (37.5), Stress and time management (37.5), Planning (35.0) *Multi-skilling (32.5), Quality management (32.5), Analytical skills (30.0), Interdisciplinarity (30.0), Process optimizing (30.0), Coaching and team building (20.0), Business development (15.0), Strategic and visionary (15.0), Project management (12.5), Social perceptiveness (10.0), Collegial management style (10.0), Change management (10.0), Creativity (5.0), Marketing skills (0.0)*	***E-skills (100.0), Communication (100.0), Language (100.0), Flexibility (100.0), Intercultural (94.4), Technical/product knowledge (83.3), Team working (72.2), Analytical skills (66.7)*** Quality management (61.1), Legislative, regulatory (55.6), Networking (55.6), Trend setting/spotting (50.0), Initiative (44.4), Creativity (44.4), Process optimizing (44.4), Social perceptiveness (38.9), Interdisciplinarity (38.9), Stress and time management (38.9), Understanding suppliers and customers (38.9), Planning (33.3), Multi-tasking (33.3), Change management (33.3) *Multi-skilling (27.8), Strategic and visionary (27.8), Project management (27.8), Coaching and team building (22.2), Business development (16.7), Marketing skills (11.1), Collegial management style (0.0)*	***E-skills (100.0), Flexibility (100.0), Stress and time management (72.7), Team working (68.2), Communication (68.2)*** Technical/product knowledge (63.6), Language (62.1), Intercultural (57.6), Multi-tasking (45.5), Analytical skills (39.4), Initiative (37.9), Legislative, regulatory (33.3), Planning (33.3) *Multi-skilling (31.8), Networking (30.3), Interdisciplinarity (30.3), Understanding suppliers and customers (21.2), Trend setting/spotting (21.2), Business development (18.2), Marketing skills (18.2), Creativity (15.2), Process optimizing (15.2), Quality management (15.2), Strategic and visionary (12.1), Project management (12.1), Change management (9.1), Social perceptiveness (0.0), Coaching and team building (0.0), Collegial management style (0.0)*	***E-skills (100.0), Communication (96.7), Language (96.7), Flexibility (95.0), Intercultural (90.0), Legislative, regulatory (85.0), Analytical skills (83.3), Planning (83.3)*** Networking (65.0), Technical/product knowledge (63.3), Creativity (53.3), Understanding suppliers and customers (51.7), Quality management (43.3), Team working (41.7), Process optimizing (41.7), Marketing skills (36.7) *Interdisciplinarity (26.7), Stress and time management (21.7), Multi-skilling (18.3), Project management (16.7), Business development (13.3), Trend setting/spotting (13.3), Change management (13.3), Social perceptiveness (10.0), Strategic and visionary (10.0), Initiative (6.7), Multi-tasking (3.3), Coaching and team building (3.3), Collegial management style (3.3)*
Data relevancy	8 occupational groups (I, II, IV, V, VIII, X, XI, XII) 9 occupational clusters defined in sector studies	10 occupational groups (I, II, IV, V, VII, VIII, IX, X, XI, XII) 13 occupational clusters defined in sector studies	9 occupational groups (I, II, IV, V, VI, VIII, X, XI, XII) 12 occupational clusters defined in sector studies	11 occupational groups (I, II, IV, V, VI, VII, VIII, IX, X, XI, XII) 18 occupational clusters defined in sector studies	10 occupational groups (I, II, IV, V, VI, VII, VIII, X, XI, XII) 18 occupational clusters defined in sector studies

Knowledge and skills transferable within sectors (across occupational groups)						
NACE / ISCO 88	**F. Electricity, gas, water and waste (NACE 40, 41, 90)**	**G. Distribution and trade (NACE 50, 51, 52)**	**H. Transport and logistics (NACE 60, 61, 62, 63)**	**I. Post and telecommunications (NACE 64)**	**J. Health and social work (NACE 85)**	**K. Other services, maintenance and cleaning (NACE 93, 95)**
All occupation groups	***Stress and time management (100.0), Flexibility (94.4), Technical/product knowledge (72.2), Creativity (72.2), Analytical skills (66.7), Multi-skilling (66.7), Project management (66.7)*** Language (50.0), Understanding suppliers and customers (50.0), Legislative, regulatory (38.9), Communication (38.9) *E-skills (27.8), Team working (27.8), Intercultural (27.8), Initiative (27.8), Process optimizing (27.8), Networking (22.2), Business development (22.2), Marketing skills (22.2), Trend setting/spotting (22.2), Change management (22.2), Strategic and visionary (11.1), Coaching and team building (11.1), Collegial management style (11.1), Quality management (11.1), Social perceptiveness (0.0), Interdisciplinarity (0.0), Planning (0.0), Multi-tasking (0.0)*	***E-skills (100.0), Communication (90.7), Flexibility (90.7), Stress and time management (75.9), Language (74.1)*** Technical/product knowledge (61.1), Intercultural (57.4), Creativity (53.7), Planning (50.0), Team working (44.4), Understanding suppliers and customers (37.0), Networking (35.2), Quality management (33.3) *Legislative, regulatory (29.6), Initiative (27.8), Analytical skills (24.1), Business development (20.4), Marketing skills (20.4), Trend setting/spotting (20.4), Strategic and visionary (20.4), Social perceptiveness (16.7), Interdisciplinarity (11.1), Multi-skilling (11.1), Coaching and team building (11.1), Process optimizing (11.1), Multi-tasking (5.6), Change management (5.6), Collegial management style (0.0), Project management (0.0)*	***Legislative, regulatory (100.0), E-skills (100.0), Intercultural (96.9), Communication (93.8), Language (93.8), Process optimizing (76.9), Flexibility (71.9), Analytical skills (70.0)*** Planning (66.3), Technical/product knowledge (65.6), Stress and time management (59.4), Quality management (58.1), Team working (57.5), Initiative (56.3), Understanding suppliers and customers (56.3), Multi-skilling (47.5), Interdisciplinarity (42.5), Creativity (42.5), Business development (37.5), Networking (34.4) *Change management (31.3), Social perceptiveness (30.0), Marketing skills (25.0), Trend setting/spotting (25.0), Strategic and visionary (25.0), Coaching and team building (21.9), Project management (21.9), Multi-tasking (20.6), Collegial management style (0.0)*	***Flexibility (90.0), Stress and time management (75.0), Understanding suppliers and customers (67.5), Process optimizing (67.5)*** Communication (65.0), Planning (65.0), Analytical skills (62.5), Technical/product knowledge (60.0), Team working (60.0), Business development (60.0), Creativity (57.5), Initiative (50.0), Networking (47.5), Multi-skilling (45.0), E-skills (40.0), Interdisciplinarity (40.0), Trend setting/spotting (40.0), Strategic and visionary (40.0), Social perceptiveness (37.5), Change management (37.5) *Language (30.0), Project management (30.0), Multi-tasking (27.5), Legislative, regulatory (25.0), Intercultural (25.0), Quality management (25.0), Marketing skills (20.0), Coaching and team building (20.0), Collegial management style (10.0)*	***Social perceptiveness (100.0), Communication (100.0), Flexibility (100.0), Intercultural (87.5)*** E-skills (50.0), Team working (50.0), Interdisciplinarity (50.0), Initiative (50.0), Creativity (50.0), Planning (50.0), Stress and time management (50.0), Change management (50.0), Legislative, regulatory (43.8), Multi-skilling (43.8), Coaching and team building (43.8), Language (37.5) *Networking (31.3), Technical/product knowledge (25.0), Analytical skills (25.0), Understanding suppliers and customers (25.0), Business development (25.0), Project management (25.0), Process optimizing (25.0), Quality management (25.0), Multi-tasking (18.8), Marketing skills (18.8), Strategic and visionary (18.8), Collegial management style (18.8), Trend setting/spotting (12.5)*	***Legislative, regulatory (100.0), Communication (100.0), Understanding suppliers and customers (100.0), Quality management (91.7), E-skills (83.3), Social perceptiveness (83.3), Planning (83.3)*** Intercultural (58.3), Multi-tasking (58.3), Multi-skilling (50.0), Creativity (41.7), Stress and time management (41.7), Flexibility (41.7), Business development (41.7), Marketing skills (41.7), Technical/product knowledge (33.3), Team working (33.3), Language (33.3) *Initiative (25.0), Networking (16.7), Analytical skills (16.7), Trend setting/spotting (16.7), Change management (16.7), Interdisciplinarity (0.0), Strategic and visionary (0.0), Coaching and team building (0.0), Collegial management style (0.0), Project management (0.0), Process optimizing (0.0)*
Data relevancy	9 occupational groups (I, II, IV, V, VI, VIII, X, XI, XII) 11 occupational clusters defined in sector studies	8 occupational groups (I, III, IV, VII, VIII, IX, X, XI, XII) 15 occupational clusters defined in sector studies	8 occupational groups (I, IV, VI, VIII, IX, X, XI, XII) 18 occupational clusters defined in sector studies	10 occupational groups (I, II, IV, V, VI, VII, VIII, X, XI, XII) 19 occupational clusters defined in sector studies	8 occupational groups (I, III, V, VIII, IX, X, XI, XII) 9 occupational clusters defined in sector studies	6 occupational groups (I, VII, VIII, IX, X, XII) 7 occupational clusters defined in sector studies

Note: The percentage value of the share of occupational groups (see data relevancy row) within separate sectors, where individual knowledge and skills are applicable, is stated in parentheses. For identification of occupational groups in the *Data relevancy* row see Table 9.

Table 9 Knowledge and skills transferable within occupational groups

Knowledge and skills transferable within occupational groups (across sectors)		
NACE / ISCO 88	**All sectors**	**Data relevancy**
I. Managers (ISCO 12, 13)	***Understanding suppliers and customers (100.0), Business development (100.0), Trend setting/spotting (100.0), Communication (90.9), Language (90.9), Intercultural (90.9), Flexibility (90.9), Strategic and visionary (90.9), E-skills (86.4), Change management (86.4), Networking (81.8), Marketing skills (81.8), Stress and time management (77.3), Legislative, regulatory (68.2), Creativity (68.2), Planning (68.2)*** Coaching and team building (63.6), Social perceptiveness (54.5), Analytical skills (54.5), Quality management (54.5), Multi-tasking (50.0), Initiative (45.5), Process optimizing (45.5), Technical/product knowledge (36.4), Multi-skilling (36.4), Collegial management style (36.4) *Team working (31.8), Interdisciplinarity (31.8), Project management (31.8)*	11 sectors (A, B, C, D, E, F, G, H, I, J, K) 14 occupational clusters defined in sector studies
II. Physical, mathematical and engineering science professionals (ISCO 21)	***Technical/product knowledge (89.3), Flexibility (85.7), Team working (84.5), E-skills (82.1), Communication (81.0), Analytical skills (81.0), Stress and time management (72.6), Intercultural (69.0), Understanding suppliers and customers (69.0), Networking (67.9), Creativity (66.7)*** Language (64.3), Project management (63.1), Initiative (60.7), Trend setting/spotting (59.5), Process optimizing (57.1), Interdisciplinarity (52.4), Coaching and team building (47.6), Quality management (46.4), Multi-skilling (44.0), Legislative, regulatory (38.1) *Social perceptiveness (28.6), Planning (28.6), Business development (28.6), Strategic and visionary (26.2), Change management (26.2), Marketing skills (11.9), Multi-tasking (4.8), Collegial management style (4.8)*	7 sectors (A, B, C, D, E, F, I) 7 occupational clusters defined in sector studies
III. Life science and health professionals (ISCO 22)	***E-skills (100.0), Technical/product knowledge (100.0), Communication (100.0), Language (100.0), Intercultural (100.0), Flexibility (100.0), Quality management (100.0), Legislative, regulatory (75.0), Networking (75.0)*** Team working (50.0), Social perceptiveness (50.0), Analytical skills (50.0), Interdisciplinarity (50.0), Initiative (50.0), Creativity (50.0), Planning (50.0), Stress and time management (50.0), Understanding suppliers and customers (50.0), Business development (50.0), Change management (50.0), Project management (50.0), Process optimizing (50.0) *Multi-skilling (25.0), Multi-tasking (25.0), Marketing skills (25.0), Strategic and visionary (25.0), Coaching and team building (25.0), Collegial management style (25.0), Trend setting/spotting (0.0)*	2 sectors (G, J) 3 occupational clusters defined in sector studies
IV. Business professionals (ISCO 241)	***Legislative, regulatory (94.4), Flexibility (94.4), Language (88.9), E-skills (83.3), Analytical skills (79.6), Understanding suppliers and customers (79.6), Communication (77.8), Intercultural (77.8), Stress and time management (75.9), Networking (70.4), Business development (70.4)*** Technical/product knowledge (64.8), Marketing skills (64.8), Trend setting/spotting (55.6), Creativity (53.7), Strategic and visionary (50.0), Project management (48.1), Team working (44.4), Process optimizing (42.6), Multi-tasking (33.3), Quality management (33.3) *Interdisciplinarity (27.8), Planning (27.8), Change management (27.8), Initiative (25.9), Social perceptiveness (22.2), Multi-skilling (16.7), Coaching and team building (16.7), Collegial management style (0.0)*	9 sectors (A, B, C, D, E, F, G, H, I) 16 occupational clusters defined in sector studies
V. Other professionals except business professionals (ISCO 242, 243, 244, 245)	***E-skills (87.5), Networking (87.5), Language (87.5), Flexibility (87.5), Legislative, regulatory (75.0), Intercultural (75.0)*** Communication (62.5), Analytical skills (62.5), Team working (56.3), Interdisciplinarity (50.0), Multi-skilling (50.0), Stress and time management (50.0), Technical/product knowledge (43.8), Social perceptiveness (43.8), Creativity (43.8), Planning (37.5), Change management (37.5) *Understanding suppliers and customers (31.3), Business development (25.0), Initiative (25.0), Trend setting/spotting (25.0), Strategic and visionary (25.0), Project management (25.0), Multi-tasking (12.5), Coaching and team building (12.5), Process optimizing (12.5), Quality management (6.3), Marketing skills (0.0), Collegial management style (0.0)*	8 sectors (A, B, C, D, E, F, I, J) 8 occupational clusters defined in sector studies
VI. Physical and engineering science associate professionals (ISCO 31)	***Technical/product knowledge (95.8), Flexibility (95.8), Communication (91.7), Analytical skills (83.3), E-skills (75.0), Team working (75.0)*** Process optimizing (62.5), Interdisciplinarity (58.3), Creativity (58.3), Networking (54.2), Intercultural (54.2), Stress and time management (54.2), Project management (54.2), Legislative, regulatory (50.0), Language (50.0), Initiative (41.7), Multi-skilling (41.7), Understanding suppliers and customers (41.7), Trend setting/spotting (33.3) *Coaching and team building (29.2), Quality management (29.2), Business development (25.0), Change management (25.0), Social perceptiveness (16.7), Planning (16.7), Marketing skills (16.7), Strategic and visionary (8.3), Multi-tasking (4.2), Collegial management style (0.0)*	6 sectors (C, D, E, F, H, I) 10 occupational clusters defined in sector studies

Knowledge and skills transferable within occupational groups (across sectors)		
NACE / ISCO 88	**All sectors**	**Data relevancy**
VII. Business and administrative associate professionals (ISCO 341, 342, 433)	***E-skills (100.0), Understanding suppliers and customers (80.6), Legislative, regulatory (77.8), Flexibility (77.8), Analytical skills (69.4)*** Language (61.1), Intercultural (61.1), Team working (58.3), Communication (52.8), Planning (50.0), Networking (44.4), Interdisciplinarity (41.7), Quality management (41.7), Creativity (38.9), Stress and time management (38.9), Initiative (33.3), Multi-skilling (33.3), Multi-tasking (33.3), Process optimizing (33.3) *Business development (30.6), Trend setting/spotting (30.6), Technical/product knowledge (25.0), Social perceptiveness (25.0), Marketing skills (13.9), Project management (8.3), Strategic and visionary (5.6), Coaching and team building (0.0), Collegial management style (0.0), Change management (0.0)*	6 sectors (B, D, E, G, I, K) 10 occupational clusters defined in sector studies
VIII. Clerks (ISCO 4)	***E-skills (90.9), Flexibility (90.9), Communication (86.4), Team working (68.2), Language (68.2), Intercultural (68.2), Planning (63.6)*** Understanding suppliers and customers (56.8), Stress and time management (54.5), Initiative (36.4), Multi-tasking (34.1) *Legislative, regulatory (31.8), Social perceptiveness (29.5), Technical/product knowledge (27.3), Multi-skilling (22.7), Project management (22.7), Networking (20.5), Analytical skills (20.5), Quality management (18.2), Creativity (15.9), Process optimizing (11.4), Change management (6.8), Interdisciplinarity (4.5), Business development (4.5), Coaching and team building (4.5), Marketing skills (0.0), Trend setting/spotting (0.0), Strategic and visionary (0.0), Collegial management style (0.0)*	11 sectors (A, B, C, D, E, F, G, H, I, J, K) 16 occupational clusters defined in sector studies
IX. Service workers and shop and market sales workers (ISCO 5)	***E-skills (100.0), Communication (100.0), Intercultural (100.0), Initiative (100.0), Flexibility (100.0), Language (83.3), Team working (66.7), Social perceptiveness (66.7), Creativity (66.7), Planning (66.7), Stress and time management (66.7), Multi-tasking (66.7)*** Legislative, regulatory (50.0), Technical/product knowledge (50.0), Multi-skilling (50.0), Understanding suppliers and customers (50.0) *Networking (16.7), Interdisciplinarity (16.7), Business development (16.7), Marketing skills (16.7), Coaching and team building (16.7), Change management (16.7), Quality management (16.7), Analytical skills (0.0), Trend setting/spotting (0.0), Strategic and visionary (0.0), Collegial management style (0.0), Project management (0.0), Process optimizing (0.0)*	6 sectors (B, D, G, H, J, K) 6 occupational clusters defined in sector studies
X. Craft and related trades workers (ISCO 7)	***Flexibility (90.9), Technical/product knowledge (86.4), Communication (86.4), E-skills (68.2)*** Team working (63.6), Planning (59.1), Stress and time management (59.1), Initiative (54.5), Multi-skilling (54.5), Creativity (54.5), Analytical skills (53.0), Quality management (50.0), Legislative, regulatory (37.9), Intercultural (36.4), Process optimizing (36.4), Interdisciplinarity (34.8) *Social perceptiveness (27.3), Language (27.3), Multi-tasking (27.3), Understanding suppliers and customers (18.2), Marketing skills (13.6), Project management (13.6), Business development (9.1), Strategic and visionary (9.1), Networking (4.5), Coaching and team building (4.5), Trend setting/spotting (0.0), Collegial management style (0.0), Change management (0.0)*	11 sectors (A, B, C, D, E, F, G, H, I, J, K) 18 occupational clusters defined in sector studies
XI. Plant and machine operators and assemblers (ISCO 8)	***Flexibility (100.0), Technical/product knowledge (85.0), Communication (80.0)*** Stress and time management (65.0), E-skills (60.0), Team working (56.0), Language (50.0), Intercultural (45.0), Multi-skilling (43.0), Analytical skills (41.0), Initiative (40.0), Process optimizing (39.0), Quality management (39.0), Planning (38.0) *Creativity (29.0), Legislative, regulatory (25.0), Social perceptiveness (24.0), Multi-tasking (19.0), Project management (15.0), Interdisciplinarity (9.0), Networking (5.0), Understanding suppliers and customers (5.0), Marketing skills (5.0), Business development (0.0), Trend setting/spotting (0.0), Strategic and visionary (0.0), Coaching and team building (0.0), Collegial management style (0.0), Change management (0.0)*	10 sectors (A, B, C, D, E, F, G, H, I, J) 20 occupational clusters defined in sector studies
XII. Elementary occupations (ISCO 9)	***Flexibility (81.8), Communication (72.7)*** Technical/product knowledge (63.6), E-skills (54.5), Language (54.5), Intercultural (54.5), Team working (45.5), Quality management (45.5), Legislative, regulatory (36.4), Analytical skills (36.4), Stress and time management (36.4), Process optimizing (36.4) *Planning (27.3), Multi-tasking (27.3), Multi-skilling (18.2), Social perceptiveness (9.1), Initiative (9.1), Creativity (9.1), Understanding suppliers and customers (9.1), Project management (9.1), Networking (0.0), Interdisciplinarity (0.0), Business development (0.0), Marketing skills (0.0), Trend setting/spotting (0.0), Strategic and visionary (0.0), Coaching and team building (0.0), Collegial management style (0.0), Change management (0.0)*	11 sectors (A, B, C, D, E, F, G, H, I, J, K) 11 occupational clusters defined in sector studies

Note: The percentage value of the share of sectors (see data relevancy column) within separate occupational groups, where individual knowledge and skills are applicable, is stated in parentheses. For identification of sectors in the *Data relevancy* column see Table 8.